Space Weather Technical Forecast

Issued on Monday, 06 June 2022 at 13:44 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Active Electron Fluence day 1 (6th). Chance of G1-G2/Minor to Moderate Storm intervals day 1 (6th) due to CME arrival.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with one long period C1.7 flare observed to the southeast of AR3029, peaking at 05/1225UTC. This produced a small CME but it has been analysed as non-Earth Directed. Another CME was observed leaving the southwest quadrant of the Sun around 05/1315 UTC due to a filament eruption, again this is thought to be non-Earth directed and thus there has been no Earth directed CMEs observed during the 24 hour period.
There are presently 4 numbered sunspot regions on the visible disc, with AR3026 transiting to the far side early in the period. All regions are currently small and simple, with no significant signs of development.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, was at ambient levels through much of the period, but the arrival of a CME at 06/0920 UTC caused a jump in all parameters. The solar wind speed has been slow, generally below 300 km/s but increased to 300-320 km/s upon the arrival of the CME. Density jumped from slightly above average (10-15 ppcc) to above average (30-50 ppcc). The interplanetary magnetic field strength was weak (3-7 nT), but increased to moderate (8-11 nT), with the north south component, Bz, dropping to -11 nT, it has subsequently risen to +8 nT from 06/1100 UTC. The Phi angle was largely negative (towards the Sun) but has oscillated from 06/0920 UTC. Geomagnetic activity was mainly Quiet (Kp 1-2), but a period of Unsettled (Kp 3) was observed 06/0900-1200 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at background levels. Electron flux was initially High (>1000 pfu), with a peak of 4210 pfu at 05/1535 UTC, but dropped to moderate/background levels from 05/2120 UTC. Electron fluence has been above the Active (1e8 integrated pfu) threshold, but with a declining trend. 1.92e8 integrated pfu was observed at 06/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Low to Very Low, with only a very slight chance of Moderate activity.

Solar Wind / Geomagnetic Activity: CME effects are expected during day 1 (6th), before easing on day 2 (7th). No other solar wind enhancements are currently expected through the remainder of the period, however late on day 2 into day 3 (7th/8th) there is a slight chance of a glancing impact from another CME which left the northeast quadrant of the Sun on the 4th June. Unsettled to Active geomagnetic activity is expected initially, with a chance of G1-G2 Minor/Moderate storming. Through day 2 activity should become predominantly Quiet as CME effects wane. However there is a slight chance of Unsettled to G1/Minor Storm geomagnetic activity late on the day 2 into day 3 (7th/8th) if the 4th of June CME glances Earth.

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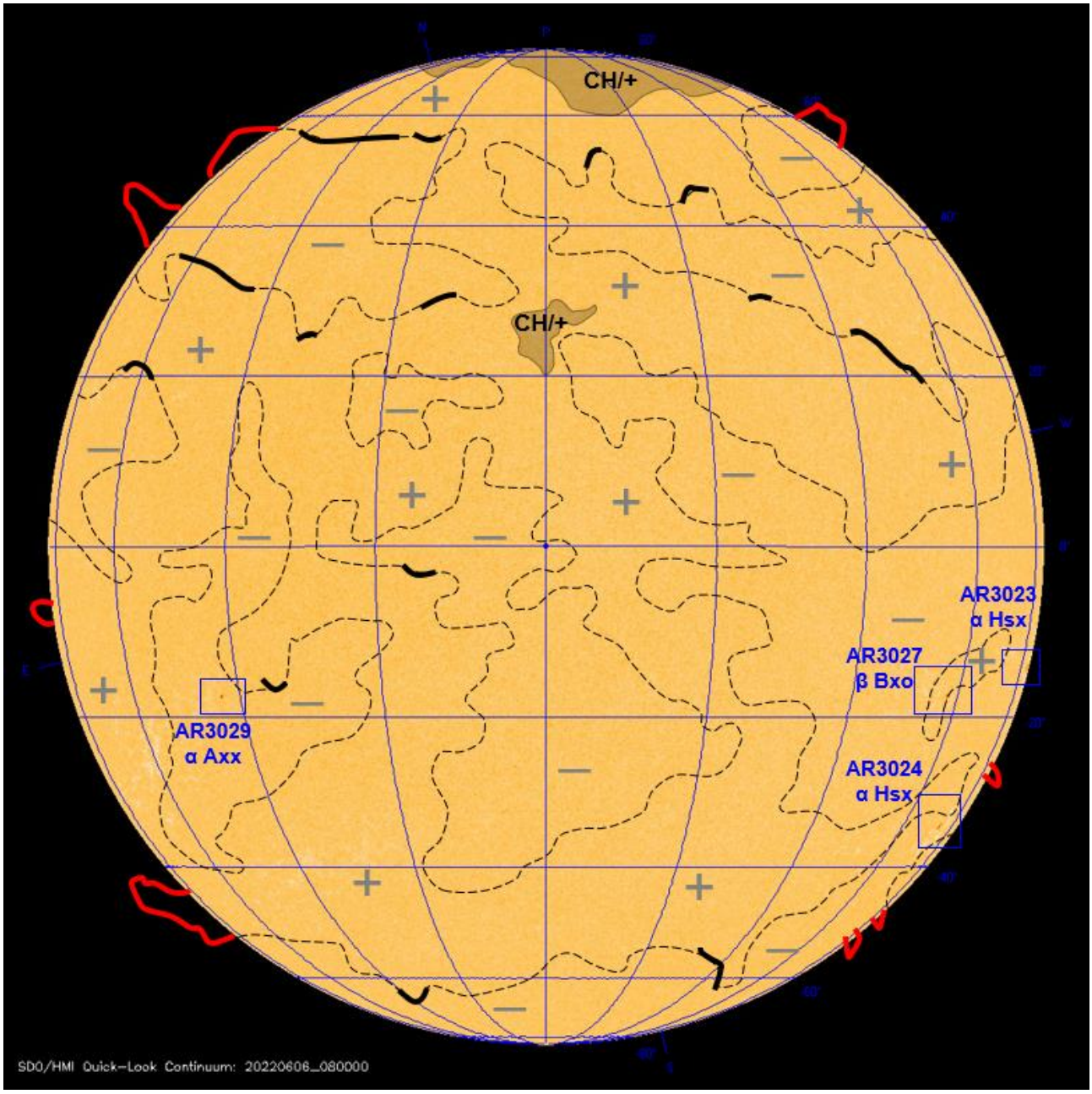
Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to be at background levels during this period. High energy electron flux (greater than 2MeV) is expected to vary between background and moderate levels. Electron fluence is expected to continue its decline below the Active (1e8 integrated pfu) threshold through day 1 (6th) and remain below this level for the rest of the period.

Figure 1. Analysis Valid 06/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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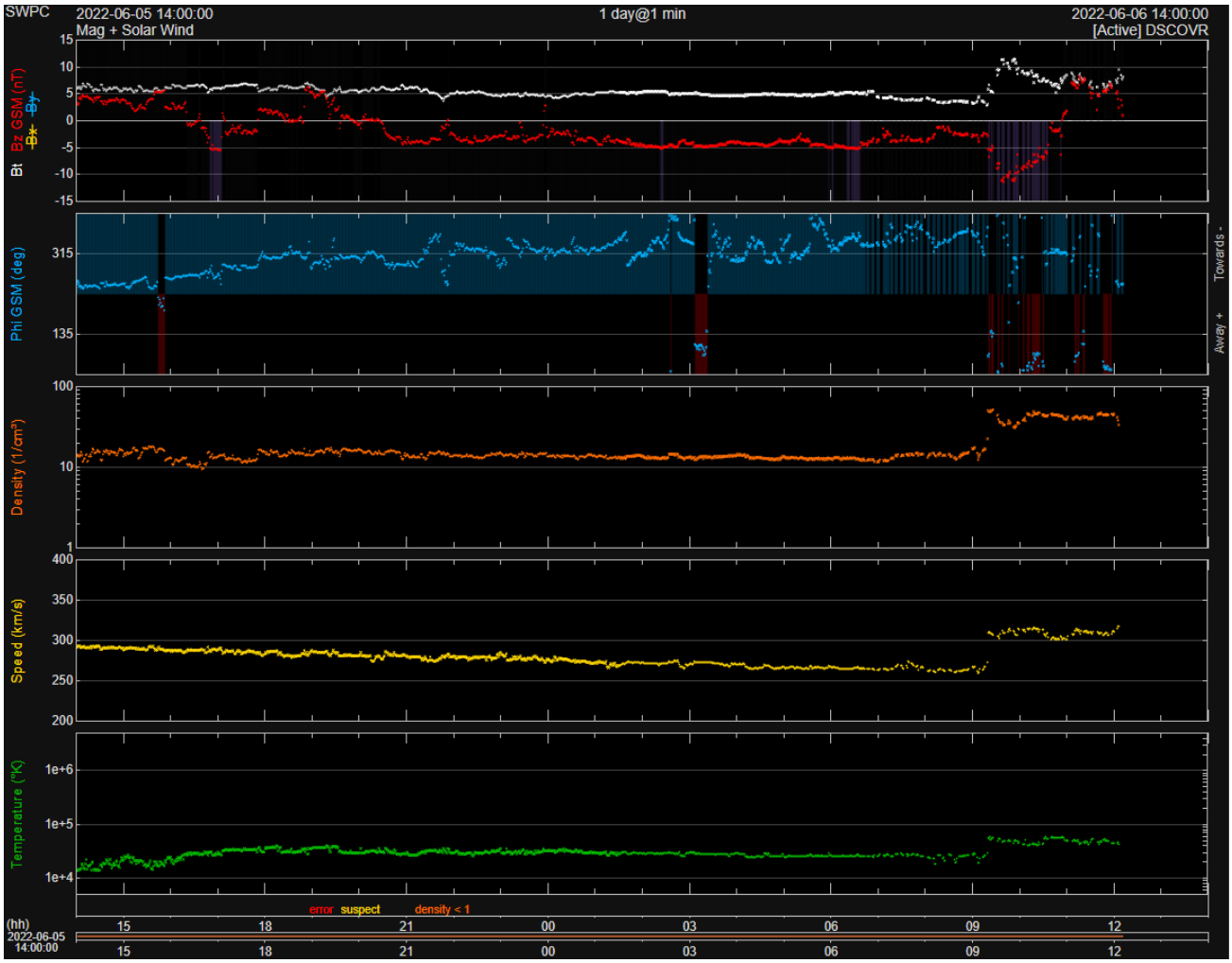
Figure 2. Solar wind parameters observed by DSCOVR at L1



Geomagnetic Storms:

A CME has recently arrived at Earth. This is likely to be from the filament eruptions that occurred on the 1st/2nd June. Affects from the CME and its magnetic cloud are likely to continue through day 1 (6th) before easing on day 2 (7th). A further CME, which left the northeast quadrant of the Sun on the 4th June is expected to miss Earth, however there is a slight chance it could produce a glancing blow late on day 2 or early on day 3 (7th/8th).
Unsettled to Active geomagnetic activity is expected initially, with a chance of G1-G2 Minor/Moderate storming. Through day 2 activity should become predominantly Quiet as CME effects wane. No other solar wind enhancements are currently expected through the remainder of the forecast period, however there is a slight chance of Unsettled to G1/Minor Storm geomagnetic activity late on the day 2 into day 3 (7th/8th) if the 4th of June CME was to glance Earth.

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Met Office Space Weather Technical Forecast

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	10	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
04/1032	Partial	Filament Eruption	32 N 30 E	620 km/s	Missing	Glancing blow possible 7th/8th

Radio Blackouts - X-Ray Flares:

There are presently four sunspot regions on the visible disc, but all of these are simple and benign, and present a very low risk of significant flare activity. A number of bright flux regions, which correspond to returning sunspot regions, are due to rotate onto the visible disc on day 3 (8th), with this reflected in a slightly increased risk of Moderate solar activity.
Otherwise solar activity is expected to be Low or Very Low.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	5	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is at background levels and is expected to remain at this level through the period.

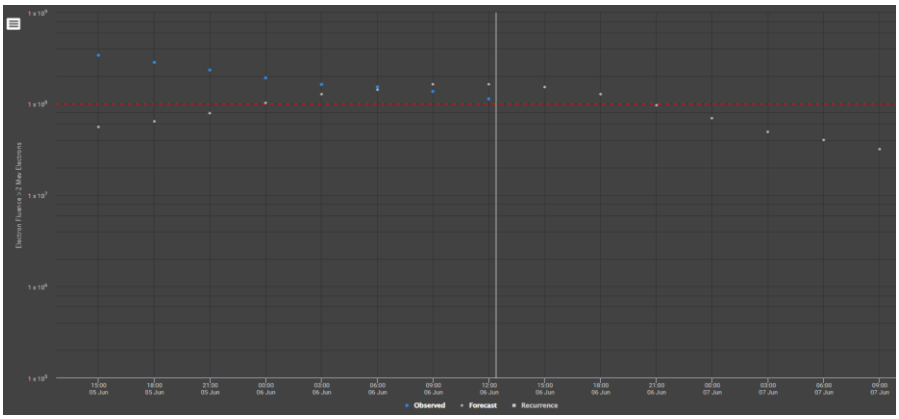
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) had previously been High (>1000 pfu) but has now dropped to background/moderate levels. A slight increase is expected once again from day 2 (7th), post CME, but levels are unlikely to exceed the High threshold.
The corresponding integrated electron fluence is expected to continue its decline below the Active (1e8 integrated pfu) threshold through day 1 (6th) and remain below this level for the rest of the period, albeit with slight increase on days 3 and 4 (8th and 9th).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	20	20	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: GOES-16 electron fluence and REFM data.



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